J Environ Stud Sci (2016) 6:712–723
DOI 10.1007/s13412-015-0272-6

Ocean use in Hawaii as a predictor of marine conservation interests, beliefs, and willingness to participate: an exploratory study

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Published online: 27 May 2015

Abstract Conservation outreach requires an understanding of the socio-ecological dynamics within specific environments and how they affect meaning given to efforts. Nationwide studies of human perceptions are important in typifying how people use and view the marine environment; however, these findings often ignore specific regional differences. The purpose of this exploratory study was to investigate whether demographics and ocean use predict environmental concerns, interest in learning, and ocean conservation in Hawaii. Drawing on data from the Ocean Topics Public Attitudes Survey (n=422), regression analysis was used to create four models that predict participant attitudes on ocean conservation factors. Significant relationships were found between gender, Native Hawaiian ethnicity, types of ocean use, and willingness to participate in conservation activities. Key methodological approaches and findings are shared with the goal of informing better design and implementation of outreach to help understand ocean user needs in Hawaii.

Keywords Ocean use · Recreation · Native Hawaiian · Conservation · Public attitudes · Survey

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Introduction

A growing awareness on the importance of socio-ecological dynamics that contribute to how individuals determine the value of conservation efforts has occurred over the past decade (Williams et al. 2013). Examining these socio-ecological contexts in areas with unique ecology and diverse cultures such as Hawaii creates opportunities for better understanding of how to engage ocean users. While nationwide studies such as those completed by the American Association for the Advancement of Science (2004), Pew Ocean Commission (2003), and U.S. Commission on Ocean Policy (2004) have documented public attitudes towards ocean- and climate-related issues, they do not necessarily capture resident values, even though most conservation work requires community involvement in order to have a local impact. In a similar way, marine conservation outreach necessitates an understanding of how attitudes converge and differ within a specific place. Evaluation of how best to inform the public will help to encourage community knowledge and participation in conservation, making localized studies even more critical to understanding society's motivation towards marine conservation. This study attempts to explore how sociodemographic background and ocean use predict attitudes and perceptions towards ocean conservation in Hawaii. While multiple approaches to place-associated culture in a conservation context have been attempted (Williams 2008), this study emphasizes ocean use as an important variable for engagement in marine issues and willingness to participate.

Hawaii context

The Hawaiian Islands make for an interesting study as they have distinctive, culturally rich traditions, and an indigenous community who continue with traditional practices. Approximately one third of the population identifies as Native

Hawaiian/Pacific Islander, while past and current immigration from Asia, Europe, and the Americas has resulted in a diverse culture, a state where the "minority" is the majority. A quarter of Hawaii residents identify as White only, as compared to 77 % of the US population (U.S. Census Bureau 2010).

Culture and recreation are formed around the islands' marine resources, with the ocean no further than 20 miles away from the most inland point (PacIOOS 2013). Hamnett et al. (2004) surveyed Hawaii residents and found that 66 % of households had one or more members involved in ocean swimming, with an average of 28 annual swimming trips. Hawaii offers a plethora of opportunities to engage with the ocean, including several activities that are unique to the islands. A long tradition of Hawaiian culture has preserved marine pursuits, including paddling outrigger canoes, fishing, *limu* (seaweed) collecting, and surfing. In 2000, Hawaii was ranked as one of the top states for marine recreation, including 4,540,543 visitors and resident ocean users (Leeworthy and Wiley 2001), making it an ideal study site to explore the relationship between ocean use and attitudes towards ocean conservation.

Conservation, ocean use, and conservation attitudes within a local context

Conservation within a local context requires an understanding of the historical and cultural knowledge, emphasizing the framework from which people derive meaning and identity (Williams et al. 2013). Part of this identity is a consequence of the individual's demographic characteristics, which in turn contributes to environmental values and behavior. Previous research has found sociodemographic correlates of attitudes towards conservation; women, for example, report more pro-environmental behavior and attitudes such as being more likely to eat less fish if it would protect resources (Hunter et al. 2004) and hold more concern towards marine mammal conservation (Howard and Parsons 2006). Youth populations, especially teens, also express greater levels of concern about ocean issues (Ocean Project 2009), while higher education and income levels have also been linked to increased environmental concern (Dennis and Zube 1988). Despite these findings, sociodemographic predictors of environmental concern can also be inconclusive and contradictory (Barker and Dawson 2010; Klineberg et al. 1998). For example, racial/ethnic minorities have been found to associate with more pro-environmental behavior when engaged in outdoor recreation activities (Larson et al. 2011), while other analyses show negative attitudes and behavior towards the environment (Westdal et al. 2013). Results have varied from study to study depending on the ways in which the sociodemographic relationship to the environment is explored, as well as research methodology (Lynch 1993; Whittaker et al. 2005).

In addition to sociodemographic characteristics, how individuals use the ocean environment could affect their attitudes and behaviors towards conservation. Environmental education scholars like Sheppard and McNeely (1997) argue that by providing an opportunity for outdoor learning through experience and use, participants can develop an ethic for nature conservation. Researchers have also demonstrated that increased visitation to the ocean has a positive effect on subjective and objective forms of marine knowledge, with those frequently participating in ocean use holding a greater concern for its conservation (Lehto et al. 2004; Steel et al. 2005). Case studies exploring particular types of recreation such as canoeing (Kauffman 1984), boating (Cottrell 2003), surfing (Lazarow et al. 2008; Pearson 1994), fishing (Chipman and Helfrich 1988), whale watching (Jacobs and Harms 2014), and scuba diving (Meisel-Lusby and Cottrell 2008) suggest that recreational specialization can influence environmentally responsible behavior. As participants become knowledgeable in one particular pursuit, groups can influence behaviors through these organized interests and help to develop social norms (Thapa et al. 2005).

Studies looking at various participations in ocean recreation leading to behavior change have generated mixed results in the past (Thapa 2010). According to Thapa (2010), earlier recreation research produced weak outcomes, which has steadily improved over time as methodologies have become more stringent. This has led to studies that provide greater detail relating outdoor recreational participation to developing pro-environmental behavior orientations. For example, Peterson et al. (2008) and Thapa (2010) show that appreciative outdoor recreation activities can lead to changed pro-environment behaviors. This is also true of studies examining appreciative ecotourism activities such as whale watching (Luksenburg and Parsons 2014).

The Ocean Topics Public Attitudes Study will not focus on participant behaviors, but instead highlight how attitudes towards ocean conservation are predicted by ocean activity and the ways that individuals engage with the ocean, including commercial operations, scientific uses, and cultural practices.

Centers for Ocean Sciences Education Excellence Island Earth (COSEE IE)

COSEE is a National Science Foundation program with centers across the USA. Island Earth is the Hawaii-based center affiliated with the University of Hawaii, School of Ocean and Earth Science and Technology. The *Ocean Topics Public Attitudes Study* was completed as a needs assessment for COSEE Island Earth education and outreach programming. One of the main objectives was to determine issues crucial to the public, exploring how people wanted to learn more about or participate in ocean sciences and conservation. The findings of this study will allow for better program design and implementation for a variety of recreation users, and to better understand ocean user needs specific to Hawaii. Previous

studies focusing on marine recreation attitudes and perceptions have not applied the research to location-specific public education, as they offer national overviews. Place-based learning and outreach is particularly important for unique geographies such as Hawaii that are prone to in-group cultural nuances due to isolation and close proximity to the ocean.

Purpose

The purpose of this study was to explore the relationship between demographic characteristics and ocean use, with individuals' environmental concerns, attitudes, and willingness to participate in ocean conservation activities in Hawaii (see Fig. 1). More specifically, this study was designed to address whether ocean use predicts environmental concern, interest in learning, and willingness to participate in conservation activities.

Materials and methods

Data collection

The *Ocean Topics Public Attitudes Survey* (*OTPAS*) was administered in April of 2012 and 2013 at an annual Ocean Expo in Honolulu. The expo attracts many types of local ocean users targeting families, fishermen/women, boaters, and other marine enthusiasts. As a result, survey respondents were mostly island residents (97.1 %) born and raised in Hawaii (70.4 %).

A table was set up with marine science and ocean conservation themed kids' activities and information. Every person passing by the COSEE table was asked if they would like to participate in the survey. Four volunteers were stationed at the booth to intercept potential respondents. Of the 595 surveys collected (2012: 260; 2013: 335), 422 surveys with a minimum of 95 % completed items were used. It was not clear why some individuals did not finish the survey, which introduces the possibility of a sampling bias. An examination of missing data for those surveys was included in this analysis; however, no patterns were found by gender, age, and race/ethnicity. Both the 2012 and 2013 surveys were conducted in compliance with the University of Hawaii Social and Behavioral Sciences Institutional Review Board. Survey respondents were all over 18 years of age and were provided with informed consent.

Ocean topics public attitudes survey

The OTPAS contained multiple choice, ranking, and semantic differential items. The three-page instrument was divided into four sections: demographics, preference for obtaining information (not provided here), ocean use and frequency, and attitude towards environmental issues and participation. Demographic items included questions about gender, age, and race/ethnicity. Participants indicated ocean usage by checking from a list of possible pursuits, including broader categories of ocean use (e.g., commercial, scientific) and specific activities (e.g., fishing, surfing). Participants also indicated the frequency they engaged in ocean activities over the previous 3 years. Twenty-nine seven-point semantic differential rating scales (ordinal with equal value between "crucial" vs. "unimportant") were used to assess participants' perspectives on the degree environmental issues were "crucial" for the Hawaii ocean environment, whether they were interested in learning about those issues, and the degree they were interested in participating in ocean conservation activities. Surveys were slightly altered in

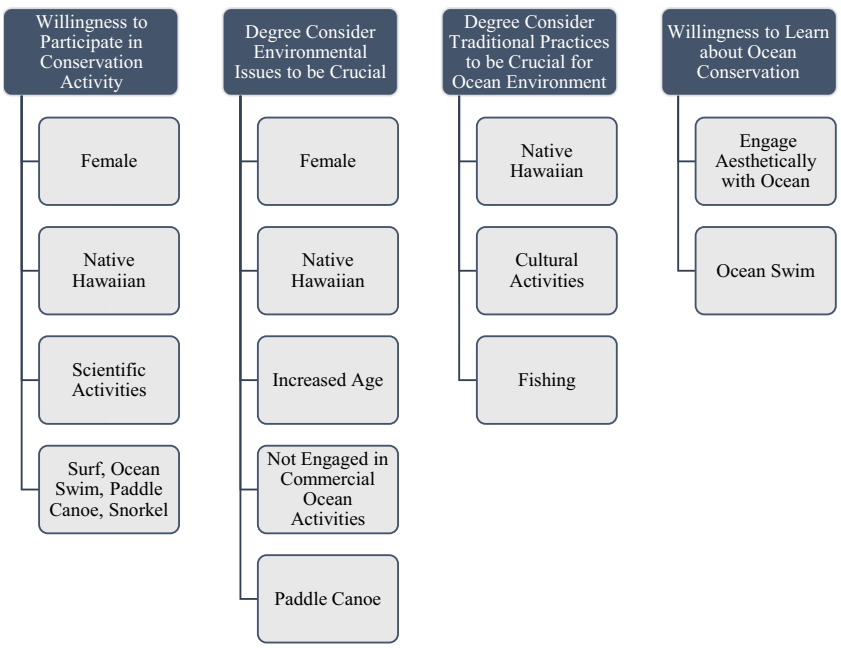

Fig. 1 Demographic and ocean use variables predicting marine conservation attitudes and willingness to participate factors

2013 to distinguish between regular and high ocean users, which may introduce some error into the calculations. To minimize this, principal component analysis was used to examine the stronger components of the responses, therefore reducing sources of variance between ocean use frequency.

Independent variables

Demographic characteristics and participants' reported ocean usage served as the independent variables for this study (see Table 1).

Demographics

Given a list of options, participants were asked to indicate their race/ethnicity and gender. These dichotomous categorical variables were given a score of No=0 and Yes=1 (race/ethnicity), and Female=0, Male=1 (gender). In both the correlation and regression analysis, they were treated as continuous variables (dummy coded). For the purpose of this study, race/ethnicity categories were considered mutually exclusive. Persons who identified with more than one race category (other than Native Hawaiian/Pacific Islander) were included in the Multi/other category. In order to assess whether the survey had reached a representative sample of the Native Hawaiian community, persons who identified themselves in more than one category that included Native Hawaiian were only put in the "Native Hawaiian" category. Participants provided their age in an open-ended item on the survey. Age was treated as both continuous and as a categorical variable (18–34, 35–54, 55+); categories were consistent with previous research, with the exception of those under 18 (Leeworthy and Wiley 2001).

Table 1 Independent variables

Domain	Variable
Gender	Female=0
	Male=1
Age	18–34
	35–54
	55+
Race/ethnicity (no=0, yes=1)	Native Hawaiian/ Pacific Islander
	White
	Asian
	Multi/other
Ocean use (no=0, yes=1)	Commercial
	Cultural
	Scientific
	Aesthetic
	Sustenance
Activities (no=0, yes=1)	Windsurfing
	Limu collecting
	Scuba
	Standup paddle (SUP)
	Canoe
	Surfing
	Fishing
	Snorkel
	Wading
	Swimming

Ocean use variables

Ten ocean use and activity items were included as independent variables on the survey. Broad use categories included commercial, study/research, aesthetic, sustenance, and cultural practices; commercial use comprised of fishing, tour operation, or other ocean-related businesses. Cultural ocean use ranged from religious ceremonies to traditional ways of gaining sustenance. Specific ocean use in the survey listed activities common to the state of Hawaii including surfing, fishing, canoe paddling, and *limu* (algae) collecting. Some of the activities, such as *limu* collecting and canoe paddling, may serve more than one category, such as recreational, commercial, or cultural uses. Similar to race/ethnicity, ocean activities were given a score for participation of No=0 and Yes=1. Respondents could choose multiple use categories and activities, and had to indicate frequency within the last 3 years in order to be considered. Bivariate correlations were calculated using Pearson's correlation coefficient to determine patterns of ocean use by demographic characteristics (see Tables 5 and 6).

Dependent variables

Four dependent variables were created by reducing the 29 OTPAS attitude items through a principal component analysis (PCA) with varimax rotation. PCA is a multivariate technique used to simplify an analysis by reducing interrelated variables into a smaller set of uncorrelated variables, i.e., "factors," while keeping the variation from the original set (Jolliffe 2002). By limiting the number of variables, the reduction of data using PCA aids in interpretation of the findings. In order to account for the most variance, only those factors with eigenvalues greater than one were included. Strong factor loadings (0.532–0.852) and a reliability assessment using Cronbach's alpha values ranging from α=0.734–0.954 confirm the internal consistency of each factor (see Table 2).

Table 2 Dependent variables: factors of ocean concerns, interest, and willingness to participate and factor loadings (N=422)

Survey item	Factor 1	Factor 2	Factor 3	Factor 4	Cron. alpha
Factor 1: crucial for ocean					0.923
Crucial for ocean environment					
Endangered species	0.834				
Marine debris	0.826				
Coral health	0.819				
Land-based pollution	0.761				
Ocean acidification	0.760				
Recreational impact	0.744				
Climate change	0.721				
Sustainable fishing	0.699				
Invasive species	0.688				
Factor 2: learning					0.954
Interested in learning about					
Land-based pollution		0.808			
Endangered species		0.796			
Marine debris		0.782			
Invasive species		0.777			
Coral health		0.756			
Ocean acidification		0.750			
Climate change		0.717			
Factor 3: participating					0.930
Volunteer train			0.852		
Join organization			0.823		
Citizen science			0.795		
Discuss ocean issues			0.792		
Ocean course			0.781		
Beach cleanup			0.761		
Environment-friendly purchase			0.719		
Donate money			0.693		
Factor 4: traditional practices					0.734
Crucial preserving traditional practices	0.647			0.532	
Learning about preserving traditional practices/uses		0.589		0.577	
Eigenvalue	13.18	4.041	1.876	1.126	
Percentage of total variance	47.08	14.43	6.70	4.02	

The attitude factors that comprise the dependent variables in this study include the following:

Factor 1: Environmental issues are crucial for ocean conservation (M=6.3, SD=0.84). This variable reflects the degree that participants' believe that selected environmental issues are crucial for the ocean environment in Hawaii.

Factor 2: Interest in learning about ocean conservation issues (M=5.94, SD=1.2). This variable reflects the degree participants' reported interest in learning more about the researcher-identified environmental issues that affect the ocean environment in Hawaii.

Factor 3: Interest in participating in ocean conservation activities (M=5.1, SD=1.2). This interest variable is composed of nine items that range from participants reporting a willingness to change personal behaviors to more community oriented activities.

Factor 4: Preserving traditional Practices as crucial to ocean conservation (M=5.9, SD=1.2). This variable reflects the degree of participants' belief that preserving traditional practices are crucial for Hawaii's ocean environment, and their interest in learning more about traditional practices as they relate to the ocean.

Data analysis

Categorical group differences were determined using descriptive statistics to make pairwise comparisons. Stepwise regression was used to create regression models to predict the relationship between gender, age, race/ethnicity, ocean use, and the environmental attitude factors (see Table 7). Using the SPSS standard stepwise regression, all independent demographic and ocean use variables were automatically added and removed into each model, stopping when variables not included in the model had p values less than or equal to 0.05. In these final models, only significant independent variables were included ($p<0.05$). The R^2 for each model is an indicator of the overall effect of the significant variables on the value of the dependent attitude factor and represents the percent of the variance (e.g., 0.15=15 %); for social survey research, a low R^2 is common (often less than 0.25). Stepwise regression is appropriate for an exploratory analysis where the goal is to define significant prognosticators within a set of multiple predictors without having a theory to design your model. Pairwise deletion was also used for the missing data in the correlation analysis and list-wise deletion in the regression analysis, resulting in a smaller number of cases in those analyzed. In an examination of the missing data by gender, age, and race/ethnicity, no patterns were found.

Results

Participant characteristics

Demographics

Survey participants embody avid ocean users and consist of a representative sample of demographic groups in Hawaii (see Table 3). Men were overrepresented to a small degree in this sample (53 %), as were those who identified as White only (28 %) and Native Hawaiian/Pacific Islander (32 %). Those who identified as Asian only were underrepresented to a moderate degree (28 %). Those that identified as Hispanic/Latino (1.7 %) or Black (<1 %) were also underrepresented in this study; because of their low numbers in Hawaii, they were included in the Mult/other category. Participants in the age ranges of 18–34 (46 %) and 35–54 (36 %) were overrepresented in the sample, and those 55+ (13 %) were underrepresented.

Ocean use

Survey results demonstrated that participants were active ocean users (Table 4). Approximately 98 % of participants reported joining ocean-related activities at least a couple times per year in the previous three years, as compared to 43 % of the general population nationally (Leeworthy and Wiley 2001). Most participants explored the ocean recreationally (93 %), while approximately half used the ocean for sustenance or aesthetics. Other use categories included scientific (24 %), cultural practices (16 %), and commercial (10 %). The most common ocean activities were swimming (89 %), followed by wading (67 %), snorkeling (63 %), fishing (61 %), and surfing (46 %).

Men in this sample were more likely to use the ocean for sustenance $r(414)=0.153$, $p=0.002$, and all ocean activities except swimming and wading. The younger the participant, the more likely they were to use the ocean for aesthetic $r(388)=-0.135$, $p=0.008$, scientific $r(388)=-0.197$, $p=000$, or cultural reasons $r(388)=-0.138$, $p=0.006$, and to swim $r(388)=-0.141$, $p=0.005$, surf $r(392)=-146$, $p=0.004$, stand up paddle $r(392)=-137$, $p=0.006$, and snorkel $r(392)=-122$, $p=0.015$. Asian respondents were more likely to fish $r(395)=0.247$, $p=000$, and less likely to participate in other ocean activities. Native Hawaiian/Pacific Islanders were more likely to be active in sustenance $r(399)=0.181$, $p=0.000$ and cultural activities, and more likely to collect *limu* $r(399)=0.181$, $p=0.000$, swim $r(399)=0.101$, $p=0.043$, surf $r(399)=0.119$, $p=0.018$, paddle canoe $r(399)=0.106$, $p=0.034$, and fish $r(399)=0.211$, $p=0.000$. White respondents were less likely to use the ocean for cultural reasons, $r(395)=-0.101$, $p=0.047$, and more likely to use it for aesthetic $r(395)=0.259$, $p=0.000$ and scientific purposes $r(395)=0.326$, $p=0.000$, as well as swim $r(399)=0.146$, $p=0.003$, scuba dive $r(399)=0.381$, $p=0.000$, and snorkel $r(399)=0.201$, $p=0.000$. While these correlations were significant, they were small and should therefore be interpreted with caution (Tables 5 and 6).

Regression models

The stepwise regressions resulted in four significant models presented in order of strength (see Table 7). Age, gender, and ocean use variables played noteworthy roles in accounting for variance in the attitude factor scores. Native Hawaiian/ Pacific Islander was the only significant race/ethnicity variable.

Model 1: Willingness to participate in ocean conservation activities. Gender ($\beta=-0.264$, $p=0.000$), Scientific activities ($\beta=0.158$, $p=0.003$), Surfing ($\beta=0.216$, $p=0.000$), Swimming ($\beta=0.127$, $p=0.015$), Canoe paddling ($\beta=0.136$, $p=0.012$), and Snorkeling ($\beta=0.111$, $p=0.054$) were all significant predictors of the factor Participate ($R^2=0.20$, $p<0.01$), with this model predicting approximately 20 % of the variance.

Model 2: Degree environmental issues are crucial for ocean conservation. Gender ($\beta=-0.116$, $p=0.037$), Age ($\beta=0.181$, $p=0.002$), Native Hawaiian/Pacific Islander ($\beta=0.221$, $p=0.000$), Commercial ocean use ($\beta=-0.149$, $p=0.000$), and Canoe paddling ($\beta=0.135$, $p=0.014$) were significant predictors

Table 3 Demographic profile variables (N=422)

	Number	% Participants	% Hawaii population[a]
Gender			
Female	196	47	49.6
Male	224	53	50.4
Missing	2	<0.1	–
Race/Ethnicity			
Native Hawaiian/Pacific Islander	134	32	21 Nat. Haw; 4 Pac Isl.
White	120	28	25
Asian	117	28	38
Other	30	7	12
Missing	21	5	–
Age			
18–34	194	46	21
35–54	152	36	27
55+	55	13	27
Missing	21	5	–

[a] Statistics taken from U.S. Census Bureau (2010)

of the Crucial Issues factor (R^2=0.10, p<0.01), with this model predicting approximately 10 % of the variance.

Model 3: Preserving traditional practices as crucial to ocean conservation. Native Hawaiian/Pacific Islanders (β=0.191, p<0.001), Cultural Practices (β=0.139, p=0.013), and Fishing (β=0.143, p=0.010) were all significant predictors of Preserving Traditional Practices (R^2=0.09, p<0.01), with this model predicting 9 % of the variance.

Model 4: Interest in learning about ocean conservation issues. Those participants who reported using the ocean for Aesthetic reasons (β=0.121, p=0.033) and Swimming (β=0.112, p=0.048) were significant predictors of the Learn factor (R^2=0.02, p<0.01), with this model predicting 2 % of the variance.

Table 4 Ocean use and activity variables (N=422)

Variable	Number	% Participants
Ocean use		
Commercial	41	10
Cultural	66	16
Scientific	99	24
Aesthetic	206	49
Sustenance	213	51
Recreation	390	93
Ocean activities		
Windsurfing	12	3
Limu collecting	75	18
Scuba	100	24
SUP	155	37
Canoe paddling	175	41
Surfing	196	46
Fishing	256	61
Snorkel	264	63
Wading	284	67
Swimming	375	89
Missing	32	7

Discussion

The results of this study have applications for ocean science and conservation outreach. They suggest that sociodemographic characteristics in combination with ocean use variables are significant predictors of belief in the urgency of current environmental issues, interest in learning more about these issues, and willingness to participate in ocean conservation activities. These data can be used for more informed program development, particularly for Hawaii audiences. In Hawaii, many marine science community initiatives exist and the information presented in the OTPAS can help to augment programs to bring in new audiences by targeting specific kinds of participants. The COSEE Island Earth program is using this information to better understand community participation in marine science programming and to share with other organizations for improved community outreach. The outcomes of this survey will better inform community partners about specific groups such as young canoe paddlers that have interest in conservation, so that they can target their messages, improving efficiency and maximize impact.

Table 5 Correlations of demographic and ocean use independent variables

	Sustenance	Commercial	Cultural	Aesthetic	Scientific	Recreation
Gender (F=0, M=1)	0.153**	0.083	−0.016	−0.091	0.047	−0.059
Age	−0.011	−0.062	−0.138**	−0.135**	−0.197**	−0.071
Asian	0.003	−0.106*	−0.172**	−0.083	−0.097	−0.038
White	−0.228**	0.092	−0.100*	0.259**	0.326**	0.073
Nat Hawaiian/Pac Island	0.247**	−0.021	0.244**	−0.207**	−0.236**	−0.058

Positive correlation in gender indicates more males engaged in ocean use activity than females

*$p<0.05$; **$p<0.01$

Sociodemographic predictors of attitude towards ocean conservation

Consistent with past research (Howard and Parsons 2006), gender was a significant predictor of environmental attitudes. In this study, women reported a greater degree of importance for the environmental issues identified in the survey and were more interested in participating in ocean conservation activities, despite the fact that men were more likely to be involved in ocean use. More men may be encouraged to become involved in environmental outreach if participation opportunities were better aligned with men's ocean use such as fishing activities. Several examples of this exist with recreational fishing contests for sustainable fish, or fishermen working with scientists to provide information and input on community-based fisheries management plans (Hartley and Robertson 2009). For women participants who are already more likely to value environmental issues, marine conservation programs should use specific promotions towards females, cueing existing interest to generate participation in specific conservation activities such as beach cleanups and community water quality monitoring programs. Targeting gender-specific recreational programs, such as canoe paddling or surfing teams and clubs, should also help reinforce conservation messaging for readily receptive audiences.

After accounting for other variables, age was another significant predictor in this study. As participants aged, they indicated greater concern for environmental issues related to ocean conservation. Again, this is similar to previous studies that imply older groups have more concern for the environment (Biodiversity Project 2002; Howard and Parsons 2006), suggesting a need for directed outreach relevant to specific age groups of ocean users. Older participants could be involved in ocean conservation programs that appeal to senior audiences, such as lectures and continuing education courses. This can be applied to existing Hawaii-based programs such as the Ocean Awareness Training (OAT),[1] a marine conservation course for the community that encourages volunteerism. Generating new interest could be achieved by targeting volunteer organizations and clubs outside of marine conservation such as local chapters of Lions[2] or Rotary[3] clubs.

Younger participants demonstrated less interest in ocean conservation activities, justifying a more aggressive outreach plan targeting younger age groups supported by family and community. Several studies have shown that positive attitudes and involvement towards the environment is heavily influenced by childhood action experiences, coupled by encouragement from parents, friends, and communities (Arnold et al. 2009; Jensen 2002). A 2003 study performed by Volk and Cheak conducted on Molokai, Hawaii, showed that community involvement and values of Hawaiian culture helped to influence youth participation. One way to engage these younger groups may be to pair them with older ocean recreation participants, who have statistically shown to be more interested in marine conservation. Another can be through ocean recreation, specifically aiming messages at activities popular among youth such as surfing and standup paddling. Examples of this currently exist with ocean conservation organizations like Surfrider[4] and Surf Aid.[5]

Survey participants who identified as Hawaiian and/or Pacific Islander showed the greatest belief in preserving traditional Hawaiian practices for ocean conservation and were more likely to use the ocean for cultural activities such as *limu* collecting. Given the strong cultural ties present in the survey, and the Hawaiian/Pacific Islander connection to place, not only are traditional practices important to ocean conservation but to the place-specific connection of survey participants. A growing awareness on the importance of place-based conservation and environmental education has occurred over the past decade, acknowledging the local context and specific socio-ecological dynamics that contribute to how individuals determine the value of conservation efforts (Williams et al. 2013). A place-based approach is important for ocean

[1] http://oceanawarehawaii.org/

[2] http://www.lionsclubs.org/EN/index.php
[3] https://www.rotary.org/
[4] http://www.surfrider.org/
[5] http://www.surfaid.org/

Table 6 Correlations of demographic and ocean activities independent variables

	Swim	Wade	Surf	SUP	Canoe	Fishing	Limu collect	Windsurf	Scuba	Snorkel
Gender (F=0, M=1)	−0.060	−0.116*	0.205**	0.013	0.113*	0.200**	0.107*	0.103*	0.103*	0.141**
Age	−0.141**	−0.019	−0.146**	−0.137**	−0.089	0.042	0.019	0.000	−0.021	−0.122*
Asian	−0.241**	−0.038	−0.110*	−0.135**	−0.124*	0.110*	−0.060	−0.041	−0.196**	−0.207**
White	0.146**	0.008	0.007	0.057	0.007	−0.324**	−0.081	0.057	0.381**	0.201**
Nat Hawaiian/Pac Island	0.101*	0.050	0.119*	0.097	0.106*	0.211**	0.181**	0.010	−0.178**	−0.064

Positive correlation in gender indicates more males engaged in ocean use activity than females

*$p<0.05$; **$p<0.01$

conservation outreach in Hawaii, whose unique ecology, diverse cultures, and opportunities for ocean engagement necessitates a localized, nuanced approach (Lemus et al. 2014).

Based on the results of the survey, COSEE plans to further develop outreach that includes traditional practices related to marine conservation. The importance of issues to the Native Hawaiian community combined with the growth in education programs surrounding traditional practices underscore the need to include culturally relevant education concepts. Activities tied to specific Hawaiian management techniques such as *fish ponds* may resonate with this group, helping to bridge the connection between cultural practices and ocean conservation.

Ocean use as predictor of attitude towards ocean conservation

In this study, ocean use was examined as one indicator of how participants related to the local ocean environment. The findings suggest that involvement in particular uses, whether they be commercial, scientific, cultural, or recreational has some relationship to participants' attitudes towards ocean conservation. Outreach activities and programs targeted at raising interest and participation in ocean conservation may need to be developed for several distinct audiences. Commercial tour operators, for instance, may have different ways of participating in ocean conservation, such as putting up awareness posters on their boats or subscribing to eco-certifications. Recreation groups, on the other hand, who may do better with conservation efforts related to their sport (e.g., surfing tournament fundraiser). Recreation activities were the predominant ocean use type in Hawaii and proved to be significant predictors of reported importance of environmental issues and willingness to learn or participate in environmental activities. This is consistent with other studies that have linked participation in outdoor recreation activities to positive attitude and behavior changes towards the environment (Barker and Dawson 2010; Larson et al. 2011). Surfers, swimmers, and snorkelers were more likely to report interest in participating in ocean conservation activities, and swimmers were more likely to be interested in learning about ocean conservation issues. The underlying reasons for this distinction with swimmers are currently unclear, but may be related to the broader demographic variability of swimmers as a group in this survey.

Those who indicated participation in paddling activities scored significantly higher in valuing preservation of traditional practices for ocean conservation. This example illustrates that there can be overlapping uses for certain activities like paddling, which can be viewed as a recreational activity, cultural practice, or both. Canoe paddlers were also more likely to report that environmental issues in the survey were crucial to Hawaii conservation and were more interested in participating in ocean conservation. Canoe paddling is a highly social activity with clubs and competitions throughout the state. Given these findings, focusing on paddlers and their organizations may prove to broaden local environmental outreach. COSEE Island Earth has begun partnering with ocean conservation organizations such as Eyes of the Reef[6] to provide educational outreach programming at paddling competitions.

Many participants also reported professional use of the ocean; ocean scientists were more interested than other marine-related career groups in engaging in ocean conservation activities. It may be that conservation work is a part of their profession, or that they have an understanding of the negative impact of issues such as climate change or ocean acidification. If true, then this argues for including scientists in ocean conservation outreach activities, as well as extending research opportunities to the community through citizen science-type activities (Barlow et al. 2015; Crain et al. 2014; Thorson et al. 2014). Allowing community members to develop a close relationship to their environment through science may change their relationship to the ocean and in turn support a change in their habits. In contrast, those participants who used the ocean commercially were significantly less likely to report that the environmental issues in the survey were crucial to Hawaii ocean conservation. Since commercial operators often introduce individuals to ocean recreation, this is an important group to better target for marine conservation messaging and provide educational opportunities. More research is needed to explore these differences in perceived urgency of

[6] http://eorhawaii.org/

Table 7 Summary of stepwise regression models for variables predicting environmental attitude factors (N=312)

	Participate conservation activities			Crucial: environmental issues			Crucial: trad practices			Learn		
Indep. variable	*B*	SE *B*	*β*	*B*	SE *B*	*β*	*B*	SE *B*	*β*	*B*	SE *B*	*β*
Gender (F=0, M=1)	−0.516	0.102	−0.264**	−0.234	0.112	−0.116*	–	–	–	–	–	–
Age	–	–	–	0.014	0.004	0.181**	–	–	–	–	–	–
Nat Haw/ Pac Islander	–	–	–	0.472	0.120	0.221**	0.408	0.120	.191**	–	–	–
Commercial	–	–	–	−0.507	0.184	−0.149**	–	–	–	–	–	–
Scientific	0.356	0.118	0.158**	–	–	–	–	–	–	–	–	–
Aesthetic	–	–	–	–	–	–	–	–	–	0.244	0.114	0.121*
Cultural	–	–	–	–	–	–	0.384	0.153	0.139*	–	–	–
Fishing	–	–	–	–	–	–	0.0291	0.112	0.143*	–	–	–
Surfing	0.421	0.109	0.216*	–	–	–	–	–	–	–	–	–
Swimming	0.396	0.162	0.127*	–	–	–	–	–	–	0.364	0.183	0.112*
Canoe	0.272	0.107	0.136*	0.275	0.112	0.135*	–	–	–	–	–	–
Snorkel	0.224	0.116	0.111*	–	–	–	–	–	–	–	–	–
R^2	0.20	–	–	0.10	–	–	0.09	–	–	0.02	–	–
F	14.08**	–	–	8.31**	–	–	11.76**	–	–	4.83**	–	–

[a] 0=female ,1=male; negative values indicate females are more likely to be interested or feel issues as more crucial

*p<0.05; **p<0.01

ocean environmental issues, but as a first step towards encouraging this user group, COSEE Island Earth recently provided a 10-week ocean communication workshop for tour operators in the Kona district of Hawaii Island.

Limitations to the study

All efforts to survey a heterogeneous section of the population were made when designing the study; however, since participants already had existing interest in ocean recreation (as a result of being at the Ocean Expo) and were 97.1 % local, an inherent bias in the study population must be acknowledged. Marino et al. (2010) recommend the incorporation of participant comparison groups when working with a nonrandom sample. Unfortunately, due to the time and financial limitations, no additional sampling was completed. However, the survey was distributed over a 2-year period to capture variation from year to year in the expo participants, and the survey was shared with other marine education partners on different Hawaiian Islands for distribution and use. As noted earlier, an additional sampling bias may also be at work due to the nonrandom nature of survey distribution without a control sample, and the number of surveys that were not included in analysis because they were not complete. For instance, those individuals who did not complete their survey may overall be less interested in ocean conservation issues. Additionally, all ocean enthusiasts that were sampled had the socioeconomic means to pay admission for the expo ($7) and had to live or reside within traveling distance to where the event was held. While appropriate for an exploratory study, findings from stepwise regression should be viewed with caution because of the possibility of overestimating significance tests. For these reasons, generalization of these finding should be made carefully.

Conclusions

These findings help to support the premise that an individual's background, including how they engage with the ocean, can predict their attitude towards ocean conservation, and their willingness to participate in conservation activities. With a clearer understanding of these relationships, marine educators can better focus outreach and support change towards more conservation-minded practices. This study has implications for universities, nonprofits, government agencies, and especially for those organizations who seek to target a specific location or issue. The research presented can also be used to help evaluate how best to inform various sectors of the public and encourage broader participation in future ocean conservation. These preliminary results are already providing valuable information for guiding the efforts of COSEE Island Earth and other educational outreach providers in Hawaii.

Acknowledgments This research would not have been possible without the generous funding the National Science Foundation Grant No. OCE1039352 and the University of Hawaii.

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